C3 Cont

determining result conditions from the difference set, the result conditions meeting effecting the preventive maintenance.

REMARKS

In the December 20, 2002 Office Action, the Examiner noted that claims 1-11 were pending in the application; objected to claim 2 and rejected claims 1-11 under 35 U.S.C. § 102(a) as anticipated by U.S. Patent 5,831,853 to Bobrow et al (Reference A in the December 20, 2002 Office Action). Claims 1-11 remain in the case. The Examiner's rejections are traversed below.

The Invention

The present invention is directed to a method for computer-supported error analysis of sensors or actuators in a technical system and particularly to the effects of externally produced errors on the system. To compare with an error-free model like that illustrated in Fig. 2 of the application, the present invention determines a status-finite description of a technical system for at least one error case of an error in a sensor or an actuator of the technical system. This is represented by sensor error models SF and actuator error models AF in Fig. 3 as described on page 6 of the English translation of the application. Two sets of achievable statuses can then be determined for the technical system, one without errors and one having an error (see page 7 and the top half of page 8). The difference between these two sets is found to determine whether the technical system can be controlled properly despite the error(s) (see the bottom half of page 8).

New Cited Prior Art: U.S. Patent 5,831,853 to Bobrow et al

The Bobrow et al. patent is directed to automatic construction of digital controllers/device drivers for electro-mechanical systems using component models. Components of the electro-mechanical system are identified and for each identified component a set of qualitative and quantitative constraints are defined (see blocks 60 and 62 of Fig. 3 as described at column 5, lines 1-8). The disclosed embodiment is directed to a paper supply system 46 (Fig. 2) for which constraints can be defined as described at column 6, lines 18-31. These constraints are used to model the dynamic behavior of the system using what is referred to as "Hybrid cc syntax" which is illustrated in Fig. 4 (see column 6, lines 36-59 and the detail in columns 8-40). These constraints are compiled into a configuration space of the system as indicated by block 64 in Fig. 3 (see column 6, lines 60-67). The transitions in the configuration space are labeled

as internal or external transitions (see block 66 in Fig. 3 and column 7, lines 1-4) and goal conditions of a desired state are identified (see block 68 in Fig. 3 and column 7, lines 4-9). Finally, control code is generated (see block 69 of Fig. 3) to drive the system from any state to the desired state, avoiding undesirable states (see column 7, lines 10-67). The definition of an "external transition" provided in the Summary of the Invention section are transitions that "occur due to events beyond the control of the controller" (column 2, lines 29-30). These "external transitions" are apparently related to "external events" which are described as inputs, such as "user input defining a desired copier operation, or series of operations" (column 3, lines 45-46) and "external variables (e.g. sensors turning ON and OFF, etc.)" (column 5, lines 51-52).

Objection to Claim 2

In item 2 on page 2 of the Office Action, claim 2 is objected to due to the reference to method step "f" which was not included in claim 1 from which claim 2 depends. Therefore, the required change from "f" to --e-- has been made. Withdrawal of the objection is respectfully requested.

Rejection under 35 U.S.C. § 102(a)

In item 4 on pages 2-3 of the Office Action, claims 1-11 were rejected under 35 U.S.C. § 102(a) as anticipated by Bobrow et al. In rejecting claims 1 and 8-11 it was asserted that Bobrow et al. discloses "computer-supported error analysis" (line 4 of item 4 on page 2 of the Office Action) at "col. 1, lines 14-34; col. 1, line 62 to col. 2, line 10; col. 5, lines 59-62; and col. 9, lines 16-30" (Office Action, page 3, lines 1-2). In addition, "col. 5, lines 1-58 and col. 15, line 50 to col. 17, line 6" (page 3, line 6) were cited as disclosing steps (b)-(e) of claim 1.

First, as noted above, Bobrow et al. is not directed to "error analysis". The words "error" or "errors" occur only five times in Bobrow et al. The first occurrence is a general statement that "construction of ... coded systems is complex and *error* prone" (column 1, lines 48-49, emphasis added) and the third occurrence is in a programming language statement at column 24, lines 64-67 in which if a page is torn the program generates an error, because such problems cannot be handled by the system taught by Bobrow et al. Thus, neither of these statements is relevant to the invention. The third and fifth occurrences are in the same statement that "the model of the rollers, in isolation, does not need to have any knowledge of potential *error* conditions" (column 10, lines 37-38 and column 27, lines 16-17, emphasis added). The only suggestion that errors are taken into account is the statement that "it is

necessary to develop a set of constraints which capture the different operations, *errors*, etc. of system 46" (column 6, lines 32-34, emphasis added). However, as seen from the previously quoted statement, Bobrow et al. specifically teaches that errors are **not** taken into account in the exemplary models. Thus, Bobrow et al. rather than anticipating the invention, teaches against even attempting to produce the invention.

The portions of Bobrow et al. cited in the rejection of step (a) of claim 1 do not contain any use of the word "error" nor has any other words been found that suggest "determining a status-finite description of the technical system for an error in case of an error of at least one of a sensor and an actuator" (claim 1, lines 5-6). The second paragraph of Bobrow et al. (column 1, lines 14-34) merely states that the resulting control code "will appropriately report information regarding a failure" (column 1, line 21), not that it would perform error analysis using any method and certainly not the methods recited in the claims. The paragraph spanning columns 1 and 2 of Bobrow et al. contains nothing whatsoever pertinent to error analysis or error conditions. The last full paragraph in column 5 merely refers to "techniques for automatic generation of code from finite state machines" (column 5, lines 60-61) and does not deal with errors at all.

The portion of column 9 that was cited contains two tasks for which the approach disclosed by Bobrow et al. was expected to be useful. The first is "Code Generation" in which it is asserted that the invention makes it "possible to develop automatically controllers which would specify ... parameters leading the system to a desirable state, and away from paths which lead to unsafe states" (column 9, lines 19-22). While the "unsafe states" may include errors, these statements contain no suggestion, let alone any teaching that would lead to anticipation, of "a status-finite description ... for an error case" (claim 1, line 5).

The second task referred to in column 9 of Bobrow et al. is "Diagnostic-tree generation" in which "possibly faulty ... behavior" (column 9, line 25) is mentioned as well as "perhaps ... other information such as prior probabilities for failure ... to construct off-line repair-action procedures" (column 9, lines 25-27). This is the only statement that has been cited or found in Bobrow et al. that even suggests any capability for producing something related to errors. However, it is submitted that these statements are not a teaching of how to determine "a status-finite description of the technical system for an error case of an error of at least one of a sensor and an actuator" (claim 1, lines 5-6) and therefore Bobrow et al. certainly does not anticipate claim 1. Furthermore, nothing has been found or cited in Bobrow et al. providing any

suggestion to one of ordinary skill in the art of how to produce a diagnostic tree using the approach disclosed therein and certainly not what is recited in step (a) of claim 1 and in similar words in claims 8-11.

The portions of Bobrow et al. cited in rejecting the remaining steps of claim 1 provide the description of blocks 60-69 in Fig, 3 and most of the description of the "basic interpreter" (column 15, line 49) which "implements the formal operational semantics" (column 15, lines 50-51) on which the invention is based. As noted above, neither of these sections contain any of the occurrences of the word "error" and nothing has been found therein suggesting "determining a second set of achievable statuses for the technical system having an error" (claim 1, lines 9-10) as recited in step (c) of claim 1 and in similar language in claims 8-11. In Bobrow et al. constraints are described as "checked for validity" (column 16, line 21), but this is not related to errors in sensors, but rather, appears to be related to confirming proper data input.

Furthermore, nothing has been cited or found that teaches or suggests step (d) of claim 1 and in similar language in claims 8-11, "forming a difference set from the first set and the second set" (claim 1, line 11), where the first set is "for the technical system without errors" (claim 1, lines 7-8) and the second set is "for the technical system having an error" (claim 1, lines 9-10). As a result, Bobrow et al. is unable to determine "result conditions from the difference set" as recited in step (e) of claim 1 and in similar language in claims 8-11.

For the above reasons, it is submitted that claims 1 and 8-11 patentably distinguish over Bobrow et al. Since claims 2-7 depend from claim 1, it is submitted that claims 2-7 similarly distinguish over Bobrow et al. for the reasons discussed above.

Changes to the Drawings

A Letter to the Examiner is submitted herewith to conform the drawings to the description thereof on page 6 of the English translation. Approval of the drawing changes is respectfully requested.

Summary

It is submitted that Bobrow et al. does not teach or suggest the features of the present claimed invention. Therefore, it is submitted that claims 1-11 are in a condition suitable for allowance. Reconsideration of the claims and an early of Notice of Allowance are earnestly solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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CERTIFICATE UNDER 37 CFR 1.8(a)

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231

on 5/20/, 20 03

STAAS & HALSEY

By: Richard A. Gollhofer

Date : 5/20/03

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please AMEND the claims according to the following (all claims are listed whether or not amended):

1. (TWICE AMENDED) A method for computer-supported error analysis of at least one of sensors and actuators in a technical system, the error analysis being in a form of a status-finite description that exhibits statuses of technical system, the method using a computer, comprising:

a) determining a status-finite description of the technical system for an error case of an error of at least one of a sensor and an actuator in the technical system;

b) determining a first set of achievable statuses for the technical system <u>without errors</u>;

c) determining a second set of achievable statuses for the technical system having an error;

d) forming a difference set from the first set and the second set; and

e) determining result conditions from the difference set, the result conditions meeting prescribable conditions.

2. (TWICE AMENDED) The method according to claim 1, wherein method steps a) through [f)] <u>e)</u> are implemented for all possible errors of sensors and/or actuators [is] <u>in</u> the technical system.

3. (AS ONCE AMENDED) The method according to claim 1, wherein failure probabilities are allocated to the sensors and/or actuators; and wherein the error analysis ensues taking the failure probabilities into consideration.

4. (AS ONCE AMENDED) The method according to claim 1, wherein method steps b)and c) ensue according to a method of model checking.

5. (AS ONCE AMENDED) The method according to claim 1, wherein a status-finite description of a process implemented by the technical system is included in the method.

6. (AS ONCE AMENDED) The method according to claim 1, wherein the status-finite description is realized by a finite automat.

7. (AS ONCE AMENDED) The method according to claim 6, wherein the status-finite is realized by a finite automat in a form of a binary decision diagram.

8. (TWICE AMENDED) A method for rapid prototyping of a technical system, the system having at least one of sensors and actuators in a technical system, the prototyping being in a form of a status-finite description that exhibits statuses of the technical system, the method using a computer, comprising:

[a)] determining a status-finite description of the technical system for an error case of an error of at least one of a sensor and an actuator in the technical system;

[b)] determining a first set of achievable statuses for the technical system <u>without errors</u>;

[c)] determining a second set of achievable statuses for the technical system having an error;

[d)] forming a difference set from the first set and the second set; and

[e)] determining result conditions from the difference set, the result conditions effecting prototyping of the technical system.

9. (TWICE AMENDED) The method error diagnosis of a technical system, the system having at least one of sensors and actuators in a technical system, the error diagnosis being in a form of a status-finite description that exhibits statuses of the technical system, the method using a computer, comprising:

[a)] determining a status-finite description of the technical system for an error case of an error of at least one of a sensor and an actuator in the technical system;

[b)] determining a first set of achievable statuses for the technical system <u>without errors</u>;

[c)] determining a second set of achievable statuses for the technical system having an error;

[d)] forming a difference set from the first set and the second set; and

[e)] determining result conditions from the difference set, the result conditions effecting error diagnosis of the technical system.

10. (TWICE AMENDED) A method for generating critical test cases for a commissioning and a system test of a technical system, the system having at least one of sensors and actuators in a technical system, the generating being in a form of a status-finite description that exhibits statuses of the technical system, the method using a computer, comprising:

[a)] determining a status-finite description of the technical system for an error case of an error of at least one of a sensor and an actuator in the technical system;

[b)] determining a first set of achievable statuses for the technical system <u>without errors</u>;

[c)] determining a second set of achievable statuses for the technical system having an error;

[d)] forming a difference set from the first set and the second set; and

[e)] determining result conditions from the difference set, the result conditions effecting the generation of critical test cases.

11. (TWICE AMENDED) A method for preventive maintenance of a technical system, the system having at least one of sensors and actuators in a technical system, the method being in a form of a status-finite description that exhibits statuses of the technical system, the method using a computer, comprising:

[a)] determining a status-finite description of the technical system for an error case of an error of at least one of a sensor and an actuator in the technical system;

[b)] determining a first set of achievable statuses for the technical system <u>without errors</u>;

[c)] determining a second set of achievable statuses for the technical system having an error;

[d)] forming a difference set from the first set and the second set; and

[e)] determining result conditions from the difference set, the result conditions meeting effecting the preventive maintenance.